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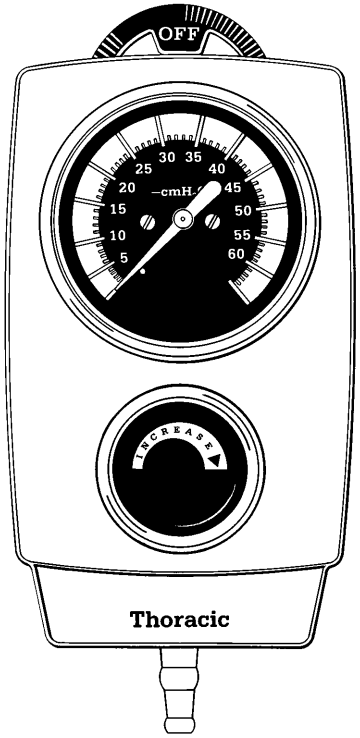
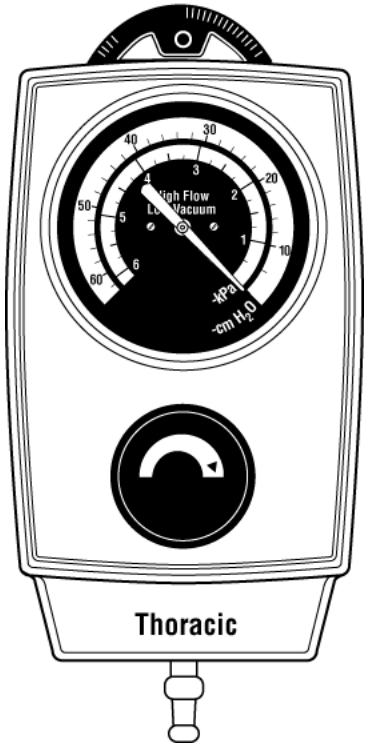
# Thoracic Vacuum Regulators

## Service Manual



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This product will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. This product must be checked periodically. A malfunctioning Product should not be used. Parts that are broken, missing, plainly worn, destroyed or contaminated, should be replaced immediately. Should such repair or replacement become necessary, Ohio Medical recommends that a telephone or written request for service advice be made to the nearest Ohio Medical service office. This product or any of its parts should not be repaired other than in accordance with written instructions provided by Ohio Medical, or altered without the prior written approval of Ohio Medical's Product Assurance Department. The user of this product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alterations by anyone other than Ohio Medical Corporation.

⚠ **WARNING: Federal law in the U.S.A. and Canada restricts this device to sale by or on the order of a licensed medical practitioner. This device is to be used only by persons who have been adequately instructed in its use.**

Important: This document is not to be reproduced in any manner, nor are the contents herein to be disclosed to anyone without the express authorization of Ohio Medical Corporation, Gurnee, IL, U.S.A.

# Technical Competence

The procedures described in this service manual should be performed by trained and authorized personnel only. Maintenance should only be undertaken by competent individuals who have a general knowledge of and experience with devices of this nature. No repairs should ever be undertaken or attempted by anyone not having such qualifications.

Genuine replacement parts manufactured or sold by Ohio Medical must be used for all repairs.

Read completely through each step in every procedure before starting the procedure; any exceptions may result in a failure to properly and safely complete the attempted procedure.

# Abbreviations Used In This Manual

| | |
|---|---|
| O | Off |
| I | On (Regulate) |
| ccw | Counterclockwise (Anti-clockwise) |
| cw | Clockwise |
| in | Inch |
| in Hg | Inches of mercury |
| kPa | Kilo Pascals (kPa x 7.50 = mm Hg) (kPa x 10.197 = cm H2O) |
| lpm | Liters per minute |
| mm | Millimeters |
| mm Hg | Millimeters of mercury (mm Hg x 0.133 = kPa ) (mmHg x 1.3595 = cm H2O) |
| cm H2O | Centimeters of water (cmH2O x 0.098 = kPa) (cm H2O x 0.7355= mmHg) |
| °C | Degrees Celsius |
| °F | Degrees Fahrenheit |
| N-m | Newton-Meter (N-m x .737 = ft-lb) |
| ft-lb | Foot-Pound Force (ft-lb x 1.356 = N-m) |
| oz | Ounces |
| DISS | Diameter Index Safety System |
| OES | Oxequip Engineering Systems |
| NCG | National Compressed Gases (Chemetron) |
| BOC | British Oxygen Corporation |
| NPT | National Pipe Thread (USA) |
| NPTF | National Pipe Thread Female (USA) |
| MPTS | Multi-Purpose Therapy Stand |
| gal | gallon |

## 1.1 Definitions

**Note:** A Note provides additional information to clarify a point in the text.

**Important:** An Important statement is similar to a note but of greater emphasis.

⚠ **CAUTION:** A CAUTION statement is used when the possibility of damage to the equipment exists.

⚠ **WARNING:** A WARNING statement is used when the possibility of injury to the patient or the operator exists.

CE European Union Representative

## 1.2 Warnings

This device is to be used only by persons who have been adequately instructed in its use.

After patient use, regulators may be contaminated. Handle in accordance with your hospital's infection control policy.

Clean and sterilize all suction equipment before shipment to ensure transportation personnel are not exposed to any hazardous contamination.

Clamping the tubing between the patient and the collection bottle may result in pressure buildup in the catheter and tubing.

When using a disposable system, the atmospheric vent at the top of the suction control chamber must be occluded for proper suction regulation with the Thoracic regulator.

The patient port of the regulator must be occluded when setting the prescribed suction level so that the patient does not receive higher than required suction levels.

A water seal must be used with the Thoracic Regulator to prevent air from entering the pleural cavity, and to indicate the presence of air leaks in the lungs and/or the collection system.

Excess *Loctite® may seal the steel ball to the seat. This will disable the vacuum relief valve and may allow suction to exceed the pre-set limit.

The vacuum relief valve must be tested to assure compliance with the manufacturer's specifications before the unit is placed in service. Remove the unit from service if it fails the test. Otherwise, excessive suction can cause injury to a patient.

With the patient tubing occluded, all bubbling in the water seal should stop so it will indicate air leaks in the lungs. If bubbling does not stop, check all connections to eliminate leaks.

When a leak free collection system connected to a patient is turned on, after initial air in the system is eliminated, only patient air will produce bubbles in the water seal.

Connect the vacuum regulator to the vacuum source only. Connection to pressure sources even momentarily could injure the patient or operator and damage the equipment.

Always connect the regulator to the vacuum source and check its operation before attaching the patient connection.

Do not use this device in the presence of flammable anesthetics. Static charges may not dissipate and a possible explosion hazard exists in the presence of these agents.

Following sterilization with ethylene oxide, quarantine parts in a well ventilated area to allow dissipation of residual ethylene oxide gas absorbed by the material. Aerate for 8 hours at 130°F (54°C).

If the vacuum regulator is repaired or disassembled in any manner, the Service Check-out Procedure must be performed before using the equipment on a patient.

The Pre-Use Check-out Procedure must be performed before using this equipment on each patient. If the regulator fails any part of the Pre-Use Check-out Procedure, it must be removed from service and repaired by qualified service personnel.

*Loctite is a registered trademark of the Loctite Corporation.

## 1.3 Cautions

Cleaning the gauge may result in damage.

Do not steam autoclave or liquid sterilize the regulator. Severe impairment of the operation of the regulator will result. The only acceptable method of sterilization is with gas (ethylene oxide).

To help prevent aspirate from entering the regulator, the Thoracic Vacuum Regulator should always be used as part of a water seal drainage system. If as a result of misuse, water or aspirate gets into the regulator, it may impair the regulator's operation.

Do not use any Loctite® products, or products which contain Methacrylate Ester as an active ingredient, to seal the probe/adapter port threads.

Only competent individuals trained in the repair of this equipment should attempt to service it.

Sterilization with ethylene oxide mixtures may cause crazing (minute superficial cracking) of some plastic parts. Crazing will be more pronounced when mixtures containing * Freon® are used.

Prior to placing the unit back into service, after disassembly or cleaning, perform the Service Check-out Procedure.

The gauge assembly must be handled with utmost care to retain its precision. If the lens is removed, do not rest the gauge on its face.

Use care when unhooking the tension spring from the regulator. Excessive tension on the spring can crack the plastic at the base of the mounting post.

To prevent stripping the plastic threads, place the screw in the hole and turn counterclockwise until it drops into the original threads. Tighten screw .

Use of lubricants other than recommended may degrade plastic or rubber components.

**Not for Field or Transport Use†**

*Freon is a registered trademark of the DuPont Company

† The categories of Field and Transport Use are specifically defined in ISO 10079-3 (BS 7259: Part 2). "Field" means use at accidents or emergencies outside a hospital. "Transport" means use in ambulances, cars or airplanes. These situations may expose the equipment to uneven support, dirt, water, mechanical shock and temperature extremes. Ohio Medical suction equipment has not been tested to comply with the specific requirements of these categories.

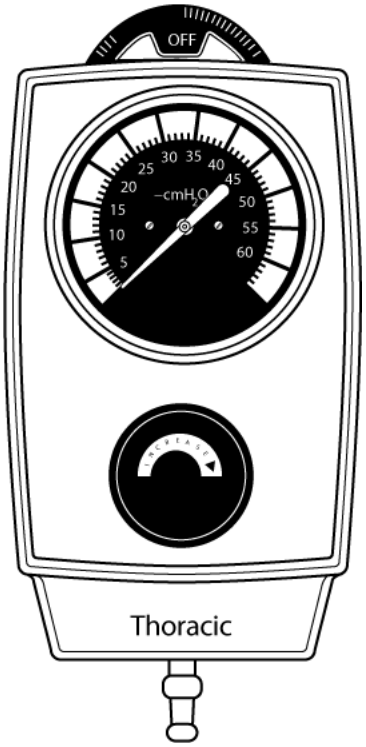
# 2/Scope

This service manual contains service, maintenance and parts information for four models of the Thoracic Vacuum Regulator.

North American
English
French
Spanish

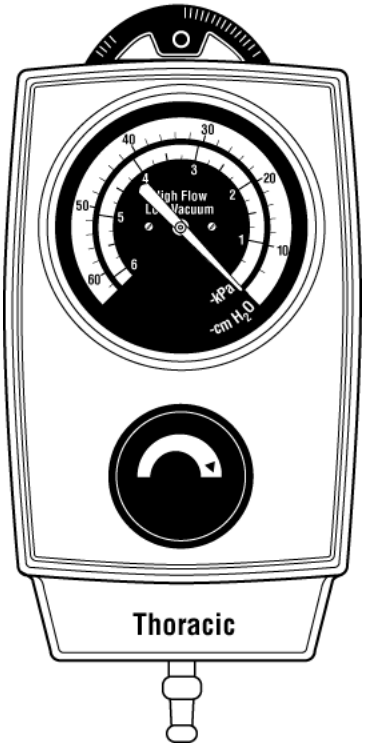
**Note:** Parts numbers are for vacuum regulators without adapters (probes).

## 2.1 North American Thoracic Vacuum Regulator




**6700-1275-901**

## 2.2 International Thoracic Vacuum Regulator

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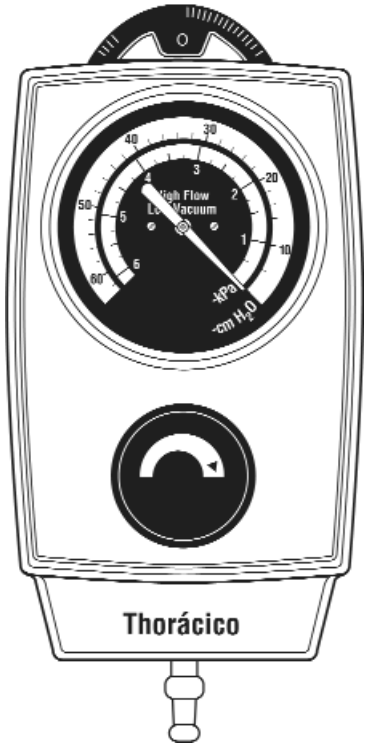
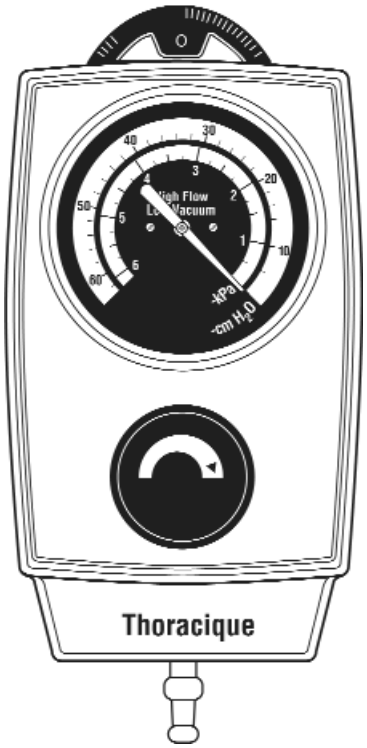
## 2.3 French
### Thoracic Vacuum Regulator




**6700-1277-901**

## 2.4 Spanish
### Thoracic Vacuum Regulator




**6700-1278-901**

## 3.1 Description

**⚠ WARNING: Do not use this device in the presence of flammable anesthetics. Static charges may not dissipate and a possible explosion hazard exists in the presence of these agents.**

The Thoracic Vacuum Regulator is a lightweight, compact unit used throughout the hospital for chest and mediastinal drainage.

Each regulator contains a vacuum gauge which indicates suction supplied by the regulator.

The Thoracic Vacuum Regulator operates only in a regulated vacuum mode. The unit has a diaphragm type regulator which provides an adjustable vacuum of 0 to 50 cm H2O (O to 4.9 kPa). The regulator has a vacuum gauge with increments to 60 cm H2O and 6 kPa and is housed in impact resistant plastic for durability.

A vacuum limiting valve is incorporated which limits the maximum vacuum to a value between 50 and 60 cm H2O (4.9 and 5.9 kPa). If positive pressure is applied to the patient port (e.g. patient coughing) a positive pressure relief valve operates to quickly relieve the pressure.

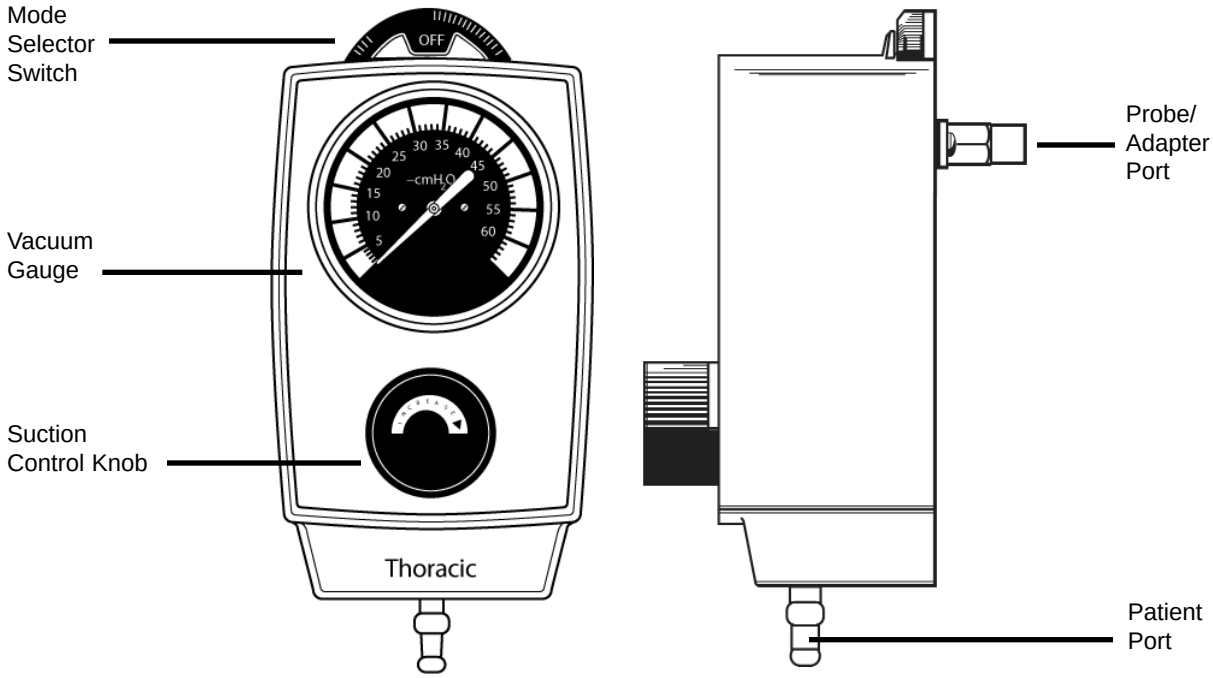
In the On/I mode, the vacuum source is connected through the regulator module which functions as an automatic valve. Turning the suction control knob adjusts the position of the regulator module and allows selection of a predetermined level of suction.

During use, as the flow requirement increases, the valve automatically opens to maintain suction at the pre-set level. Conversely, when the flow requirement decreases, the valve automatically closes to maintain suction at the pre-set level. The same mechanism compensates for changes in supply vacuum and automatically maintains the pre-set suction level.

1. Suction Control Knob - Allows easy adjustment of suction to the patient.

2. Mode Selector Switch - Allows quick and easy selection of On/Off (I/O).
   a. On/I - Suction can be adjusted with the suction control knob.
   b. OFF/O - No suction is supplied to the patient.

3. Vacuum Gauge - The suction level to the patient is displayed during use.



## 3.2 Specifications

3.2.1 Technical Specifications

| | |
|---|---|
| Gauge: | Accuracy ± 3 cm H2O (± 0.3 kPa) |
| Flow Rate: | 0 to 40 lpm without fittings at full increase setting depending on the supply vacuum and open air flow |
| Positive Pressure Safety Relief Valve: | Located in patient circuit to prevent pressurization of patient chest cavity in excess of 10 cm H2O (1.0 kPa) |
| Regulated Suction Range: | 0 to 50 cm H2O (0 to 4.9 kPa) |
| Vacuum Relief Valve: | 50 to 60 cm H2O (4.9 to 5.9 kPa) |
| Weight:<br>(less fittings) | 24 oz (680 grams) |
| Dimensions<br>(less fittings) | Height: 7.2 in (185 mm)<br>Width: 3.5 in (90 mm)<br>Depth: 4.3 in (108 mm) |
| Latex tubing<br>0.25 in (6.4 mm) I.D. | 0 to full vacuum<br>Flow dependent on source and set-up |
| Disposable tubing<br>(available separately in some markets;<br>6 mm I.D. x 450 mm, 750 mm and 2m) | 0 to full vacuum<br>Flow dependent on source and set-up<br>to connect regulator and collection bottle |
| Disposable Suction Filter: | 0 to full vacuum<br>0 to 100 lpm @ 650 mm Hg (–87 kPa) |

3.2.2 Environmental Specifications

| | |
|---|---|
| Operating Temperature Range: | 40°F (4°C) to 120°F (49°C) |
| Storage Temperature Range: | 0°F (–18°C) to 160°F (71°C) |
| Operating and Storage Relative Humidity: | 5 to 95% |

3.2.3 Standards

Certified to ISO 10079-3 (BS 7259: Part 2)

## 4.1 Equipment Set-up

If the regulator is equipped with a probe/adapter for wall outlets, insert the probe/adapter into the vacuum wall outlet. If the regulator is mounted elsewhere, connect a vacuum supply hose between the regulator's probe/adapter port and the wall outlet.

**⚠ WARNING: Connect the vacuum regulator to the vacuum source only. Connection to pressure sources even momentarily could injure the patient or operator and damage the equipment.**

**⚠ WARNING: Always connect the regulator to the vacuum source and check its operation before attaching the patient connection.**

Connect the collection system's vacuum port to the regulator's patient port with the appropriate vacuum tubing. Hospital-supplied suction tubing must be used between the vacuum regulator, the water seal, the collection bottle, and the catheter. Recommended minimum inside diameter is 0.25 in (6mm).

ISO 10079-3 (BS7259: Part 2, Section 5.1.2) states "...the usable volume of the collection container shall be not less than 500 ml."

Note: A positive pressure relief valve in the Thoracic vacuum regulator will prevent pressure buildup in the system if suction is turned off using the On/Off (I/O) switch.

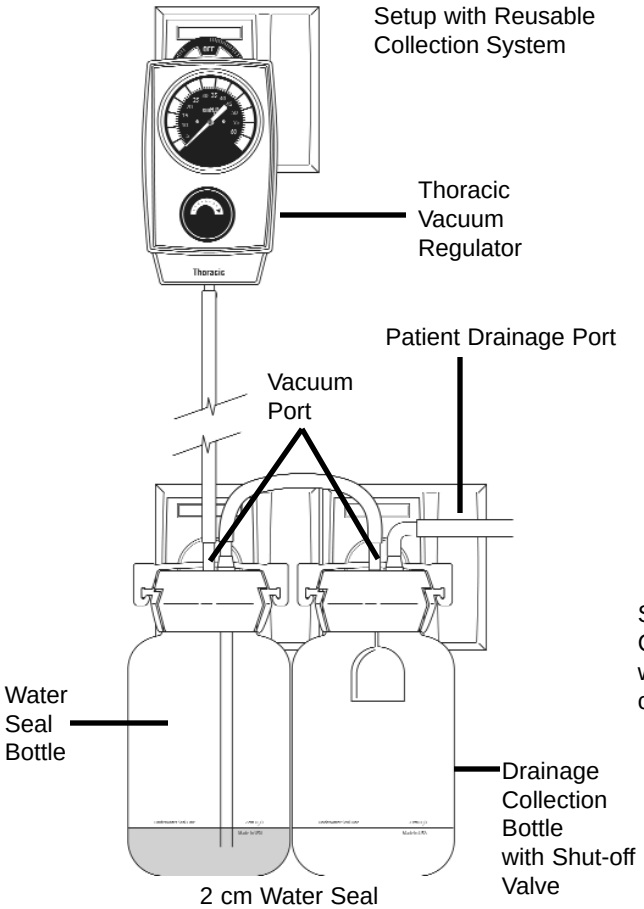
**⚠ WARNING: Clamping the tubing between the patient and the collection bottle may result in pressure buildup in the catheter and tubing.**

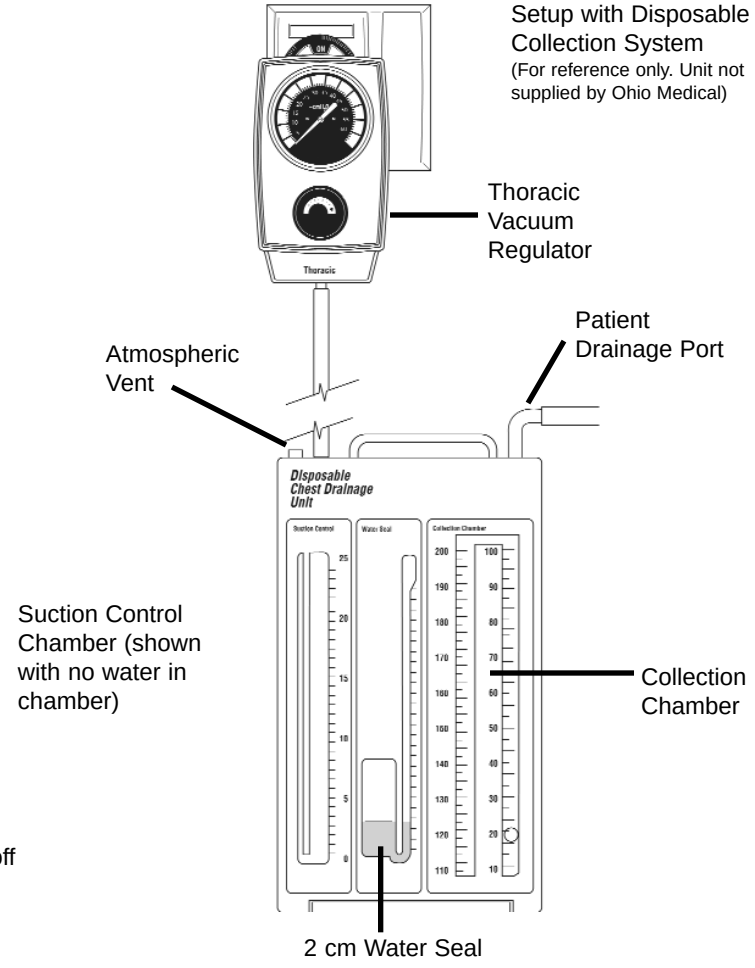
**⚠ WARNING: When using a disposable system, the atmospheric vent at the top of the suction control chamber must be occluded for proper suction regulation with the Thoracic vacuum regulator.**

**Important:** Once the atmospheric vent is occluded, the Thoracic vacuum regulator controls vacuum level regardless of the presence or amount of water in the suction control chamber.

Note: A positive pressure relief valve in the disposable collection system will prevent pressure buildup in the system if the system is clamped between the vacuum regulator and the collection device.

**⚠ CAUTION: To help prevent aspirate from entering the regulator, the Thoracic Vacuum Regulator should always be used as part of a water seal drainage system. If as a result of misuse, water or aspirate gets into the regulator, it may impair the regulator's operation.**



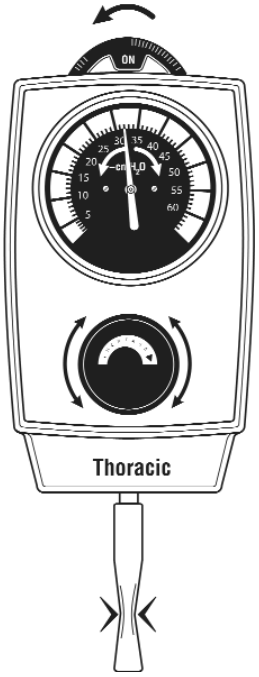


Setup with Disposable Collection System
(For reference only. Unit not supplied by Ohio Medical)
Thoracic Vacuum Regulator
Patient Drainage Port
Atmospheric Vent
Disposable Chest Drainage Unit
Suction Control Chamber (shown with no water in chamber)
Collection Chamber
2 cm Water Seal

## 4.2 Operation

4.2.1 Mode Selection

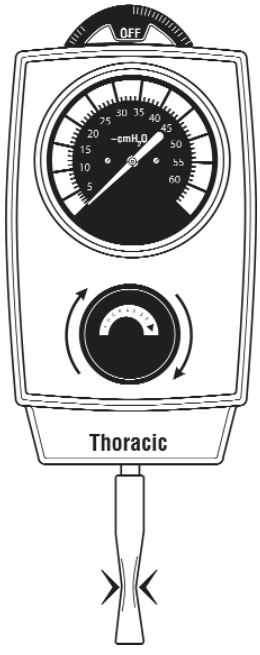
ON/I - Suction can be adjusted with the suction control knob.

OFF/O - No suction is supplied to the patient.




4.2.2 Setting the Suction Level

1. Turn the mode selector switch to ON/I.
2. Clamp the connective tubing to occlude the patient port.
3. Rotate the suction control knob until the vacuum gauge indicates the required setting.




4.2.3 Pre-Use Check-out Procedure

The Pre-Use Check-out Procedure must be performed before using this equipment on each patient. All tests must be performed with a supply vacuum of 300 mm Hg (40 kPa) minimum.

1. Turn the mode selector switch to OFF/O.

   Rotate the suction control knob one full turn clockwise (increase).

   Clamp the connective tubing to occlude the patient port. The gauge needle should not move.

Pre-Use Check-out Procedure (continued)

2. Turn the mode selector switch to ON/I.

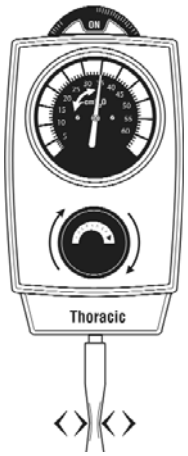
   Rotate the suction control knob fully counterclockwise (decrease).

   Clamp the connective tubing. The gauge needle should not move.

3. Clamp the connective tubing.

   Increase the suction to 35 cm H2O (3.4 kPa).

   Slowly open and close the clamped tubing to create various flow rates through the regulator. Ensure that the suction level is maintained when the tubing is clamped




4. Clamp the connective tubing.

   Rotate the suction control knob fully clockwise (increase) to verify that the relief valve opens (begins to flow) at 55 ± 5 cm H2O (5.4 ± .5 kPa). As suction is increased, the relief valve should not allow levels of more than 65 cm H2O (6.4 kPa).

5. Reduce the suction level to zero and turn the mode selector switch to OFF/O.

4.2.4 Patient Set-up

1. Make sure the Pre-Use Check-out Procedure has been performed.

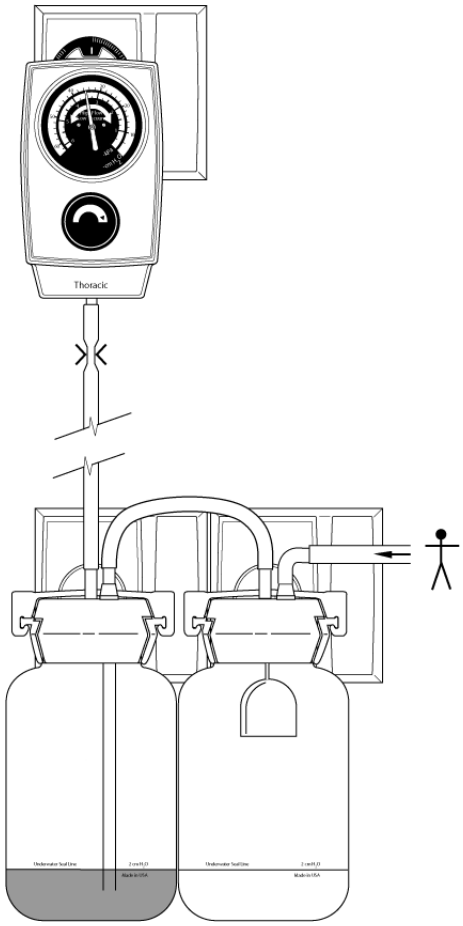
2. Turn the mode selector switch to ON/I and clamp the connective tubing.

3. Set the prescribed suction level.

**⚠ WARNING: The patient port of the regulator must be occluded when setting the prescribed suction level so that the patient does not receive higher than required suction levels.**

Important: Add the 2cm water seal amount to the level set on the regulator gauge to determine the total suction level.

4. Turn the mode selector switch to OFF/O.



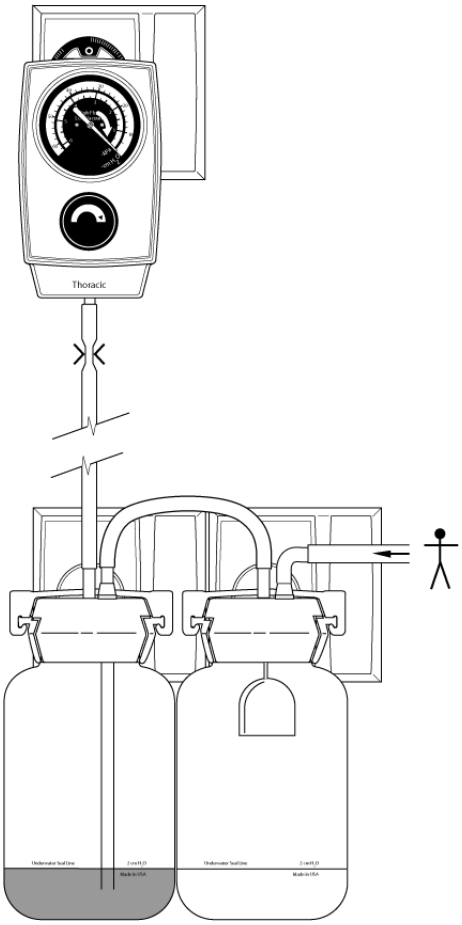

**⚠WARNING: A water seal must be used with the Thoracic vacuum regulator to prevent air from entering the pleural cavity, and to indicate the presence of air leaks in the lungs and/or the collection system.**

5. Fill the water seal to its designated level.

6. Connect the regulator to a reusable water seal (illustrated) or a disposable system with a water seal.

7. Connect the water seal to the collection bottle's vacuum port.

8. Attach the patient tubing to the collection bottle's patient port.



Patient Set-up (continued)

9. Turn the mode selector switch to ON/I.

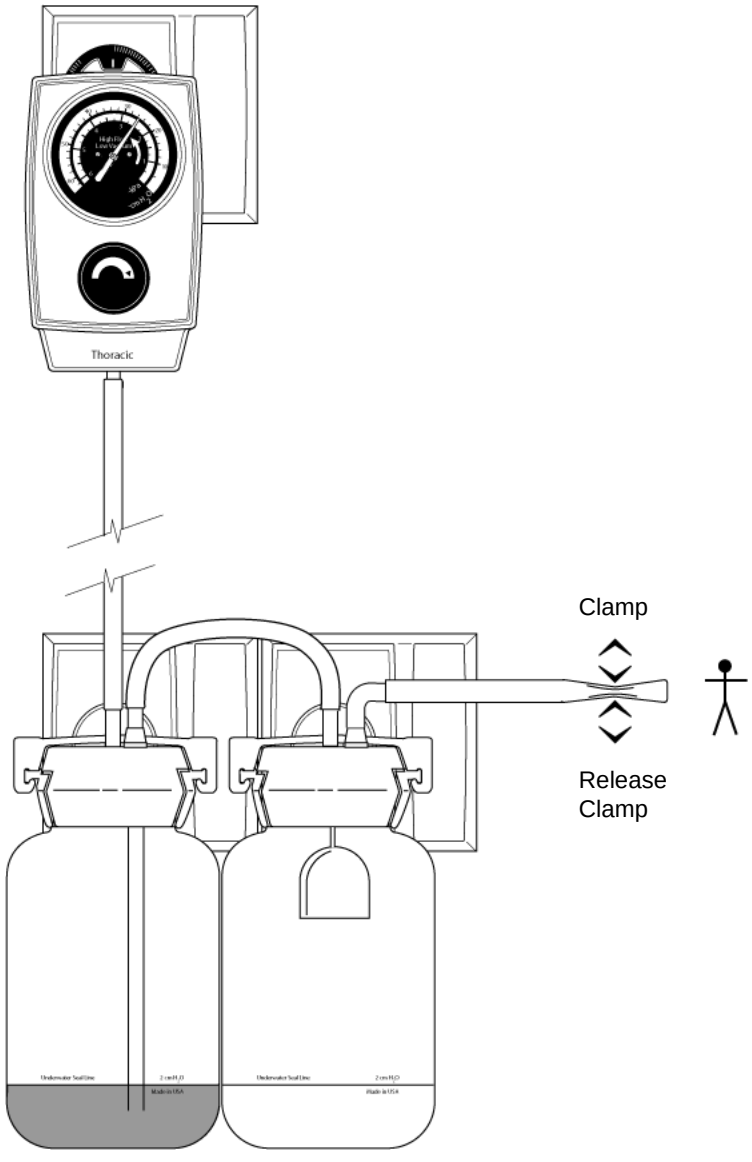
10. Clamp the patient tubing.

11. After a brief period all bubbling in the water seal should stop.

**⚠WARNING: With the patient tubing occluded, all bubbling in the water seal should stop so it will indicate air leaks in the lungs. If bubbling does not stop, check all connections to eliminate leaks.**

12. Release the clamp on the patient tubing.

**⚠ WARNING: When a leak free collection system connected to a patient is turned on, after initial air in the system is eliminated, only patient air will produce bubbles in the water seal.**



## 5.1 Cleaning

**⚠ WARNING: After patient use, regulators may be contaminated. Handle in accordance with your hospital's infection control policy.**

### 5.1.1 Routine Exterior Cleaning

Routine cleaning of the regulator is recommended as standard procedure after each use.

Wipe the exterior surfaces with a solution of water and mild detergent.

### 5.1.2 Internal Component Cleaning

The regulator requires cleaning if it becomes flooded with patient fluid as a result of misuse.

1. Refer to the Service - Disassembly and Assembly instructions. Handle in accordance with your hospital's infection control policy.

2. All internal components, with exception of the gauge, may be cleaned with a solution of warm water and mild detergent.

**⚠ CAUTION: Cleaning the gauge may result in damage.**

3. Dry all components with a lint free cloth.

4. Following cleaning, sterilize according to section 5.2.

## 5.2 Sterilization

**⚠ CAUTION: Do not steam autoclave or liquid sterilize the regulator. Severe impairment of the operation of the unit will result. The only acceptable method of sterilization is with gas (ethylene oxide).**

The regulator requires sterilization if it becomes flooded with patient fluid during use, is otherwise considered contaminated, or is to be shipped or serviced. The regulator may be sterilized using ethylene oxide (ETO). ETO sterilization will not damage the regulator or its components except as noted (see Caution below).

1. Switch the regulator ON/I and set the unit to the FULL INCREASE setting.

2. Should disassembly be required follow directions in section 7/Service - Disassembly and Assembly and handle in accordance with your hospital's infection control policy.

3. Follow the sterilizer manufacturer's directions for the correct sterilization procedures. Ohio Medical makes no claims with regard to sterilization effectiveness. Sterilization is not recommended as a standard procedure after each use.

**⚠ CAUTION: Sterilization with ethylene oxide mixtures may cause crazing (minute superficial cracking) of some plastic parts. Crazing will be more pronounced when mixtures containing Freon® are used.**

4. Adequately aerate the regulator prior to disassembly, shipment or use. Aerate parts prior to reassembly.

**⚠ WARNING: Following sterilization with ethylene oxide, quarantine parts in a well ventilated area to allow dissipation of residual ethylene oxide gas absorbed by the material. Aerate for 8 hours at 130°F (54°C).**

**⚠ CAUTION: Prior to placing the unit back into service, after disassembly or cleaning, perform the Service Check-out Procedure.**

# 6/Troubleshooting

Place the regulator in the vertical position and connect to a supply vacuum of at least 300 mmHg (40kPa) and open air flow of 60 lpm.

| Problem | Possible Causes | Remedy |
|---|---|---|
| A. No gauge indication and no suction in any setting | 1. No supply vacuum | 1.Correct supply problems |
| | 2. Kinked suction tube | 2. Straighten tube |
| | 3. Poor connection | 3. Check all connections and seals |
| | 4. Blocked probe/adapter port | 4. Clean port |
| | 5. Blocked probe/adapter | 5. Clean or replace probe/adapter |
| | 6. Blocked wall outlet | 6. Clean outlet |
| B. No gauge indication but suction is being delivered | 1. Blocked gauge pressure sensing orifice and/or gauge tubing | 1. Clean orifice and/or gauge tubing |
| | 2. Dust in gauge mechanism | 2. Gently blow out dust |
| | 3. Gauge mechanism damaged | 3. Replace gauge |
| C. Gauge indication but no suction is being delivered | 1. Blocked patient port | 1. Clean port |
| | 2. Blocked external filter | 2. Replace external filter |
| | 3. Blocked fitting | 3. Clean or replace fitting |
| D. Suction level cannot be adjusted | 1. Regulator diaphragm rupture | 1. Replace diaphragm |
| | 2. Broken or stripped control shaft | 2. Replace control shaft |
| | 3. Piston stuck in baffle guide plate | 3. Free up piston |
| E. Insufficient flow through regulator | 1. Partial blockage in wall outlet | 1a. Confirm wall supply open air flow meets minimum hospital requirements |
| | | 1b. Clean if necessary |
| | 2. Partial blockage in regulator | 2a. Perform the Flow Test in the Service Check-out Procedure Section of this manual |
| | | 2b. Clear blockage if necessary |

| Problem | Possible Causes | Remedy |
|---|---|---|
| F. Inaccurate gauge reading **Note:** All gauge needles should come to rest at the stop pin when no suction is being supplied. | 1. Damaged gauge | 1. Replace gauge |
| G No suction in any setting and whistling or vibrating noise from inside the regulator | 1. Vacuum relief valve failure | 1. Replace rubber sleeve and ensure that the steel ball is present and clean |
| | 2. Positive pressure safety relief valve failure | 2. Replace positive pressure safety relief valve |

## 7.1 Service Tools and Equipment

⚠ **CAUTION:** Use of lubricants other than recommended may degrade plastic or rubber components.

The following items should be on hand during any service procedure:

- Supply vacuum: 300 mmHg (40 kPa) minimum with 60 lpm open air flow minimum.
- Bubble leak tester
- 50 lpm flowmeter (6700-0355-800)
- Water manometer or calibrated vacuum gauge, 0 to 70 cmH2O (± 1 cm H2O)
- Water manometer or calibrated pressure gauge, 0 to 70 cm H2O (±1 cm H2O)
- Dow Corning No. 111 lubricant (6700-0074-200)
- Pliers
- Loctite 242 removable thread locker ( 6600-0058-300)
- 1/4 inch flathead screwdriver
- No. 2 Phillips screwdriver
- Internal snap ring pliers
- 5/16 and 9/16 open end wrenches
- Positive pressure source delivering 10 lpm open flow
- Toothpick (O-ring removal)

## 7.2 Disassembly

**⚠ WARNING: If the vacuum regulator is repaired or disassembled in any manner, the Service Check-out Procedure must be performed before using the equipment on a patient.**

**⚠ WARNING: After patient use, regulators may be contaminated. Handle in accordance with your hospital's infection control policy.**

**⚠ WARNING: Clean and sterilize all suction equipment before shipment to ensure transportation personnel are not exposed to any hazardous contamination.**

⚠ **CAUTION:** The gauge assembly must be handled with utmost care to retain its precision. If the lens is removed, do not rest the gauge on its face.

1. Remove the four cover mounting screws and lift off the front cover.
2. Pull the knob off of the control shaft, as well as the washer and plastic spacer on the shaft under the knob.
3. Gently slide the gauge out of its mounting and disconnect from tubing.

   **Note:** The plastic gauge lens should remain attached to the gauge.
4. Remove the connecting tube with the restricting orifice from the regulator assembly.
5. Unhook the tension spring (if present) from the ON/OFF selector switch.

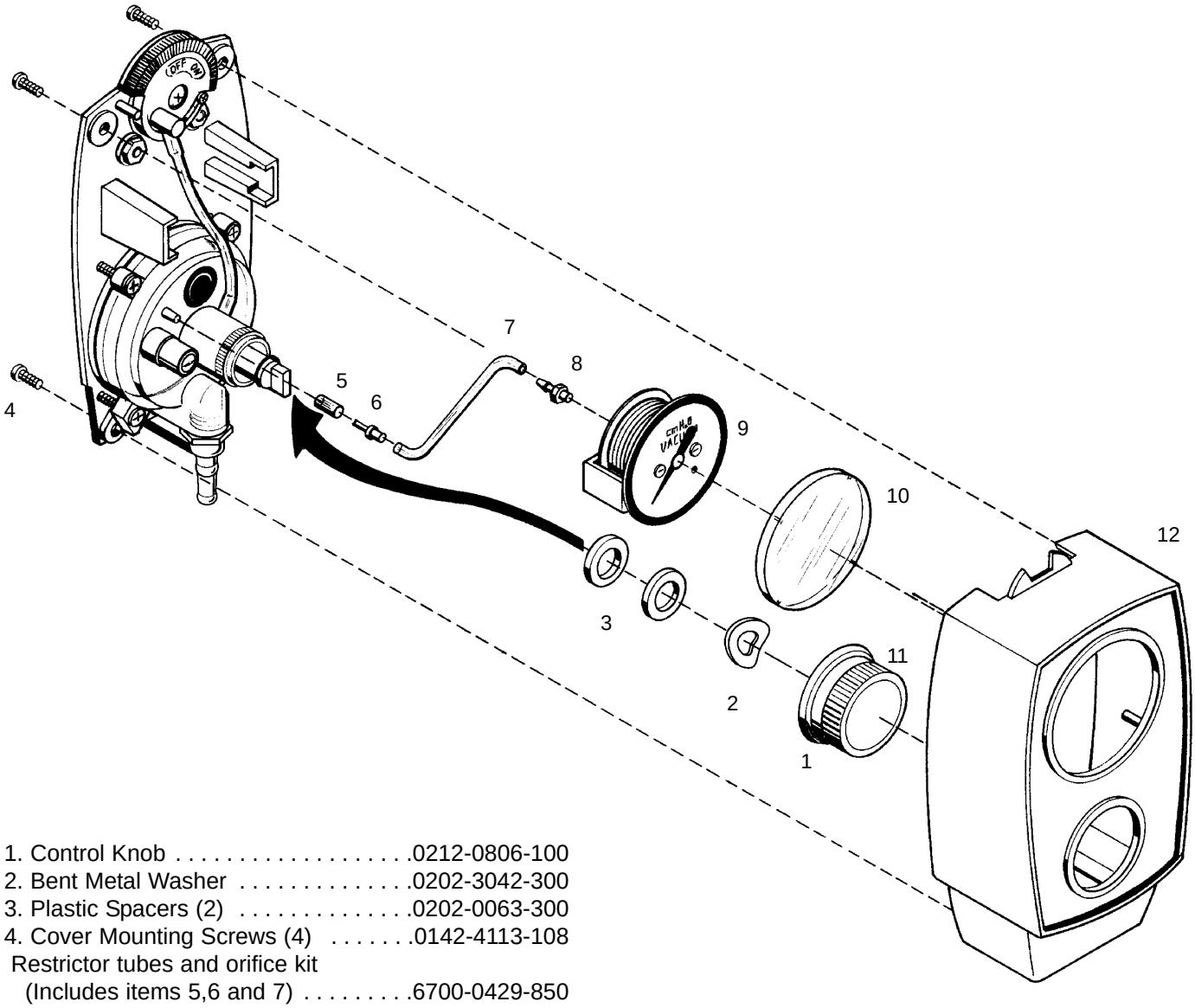
⚠ **CAUTION:** Use care when unhooking the tension spring from the regulator. Excessive tension on the spring can crack the plastic at the base of the mounting post.

6. Remove the mounting screw and spring washer from the center of the ON/OFF switch. Lift the switch from the unit, and unplug its connecting line to the regulator assembly. Use a toothpick to remove the O-ring from its recess in the back plate.
7. Unbolt the probe/adapter connector from the back plate. Use a tooth pick to remove the O-ring.
8. Pull the vacuum relief valve off its mounting vent (cup your hand under the valve to catch the ball as it falls out while unscrewing the adjustment screw).
9. Remove the regulator assembly mounting screws and lift the assembly off the back plate.
10. Take the diaphragm off the back plate.

    **Note:** The metal disc at the center of the diaphragm may be removed for further cleaning if necessary.
11. Separate the regulator assembly and remove the large O-ring seal.
12. Unscrew the patient port fitting from the regulator assembly, and remove the O-ring.

13. Using the snap ring pliers, remove the snap ring that retains the control shaft in the regulator assembly. Pull out the control shaft, and remove the spring, nut and O-ring.

**Note:** The spring button and piston should be left assembled in the baffle guide plate.



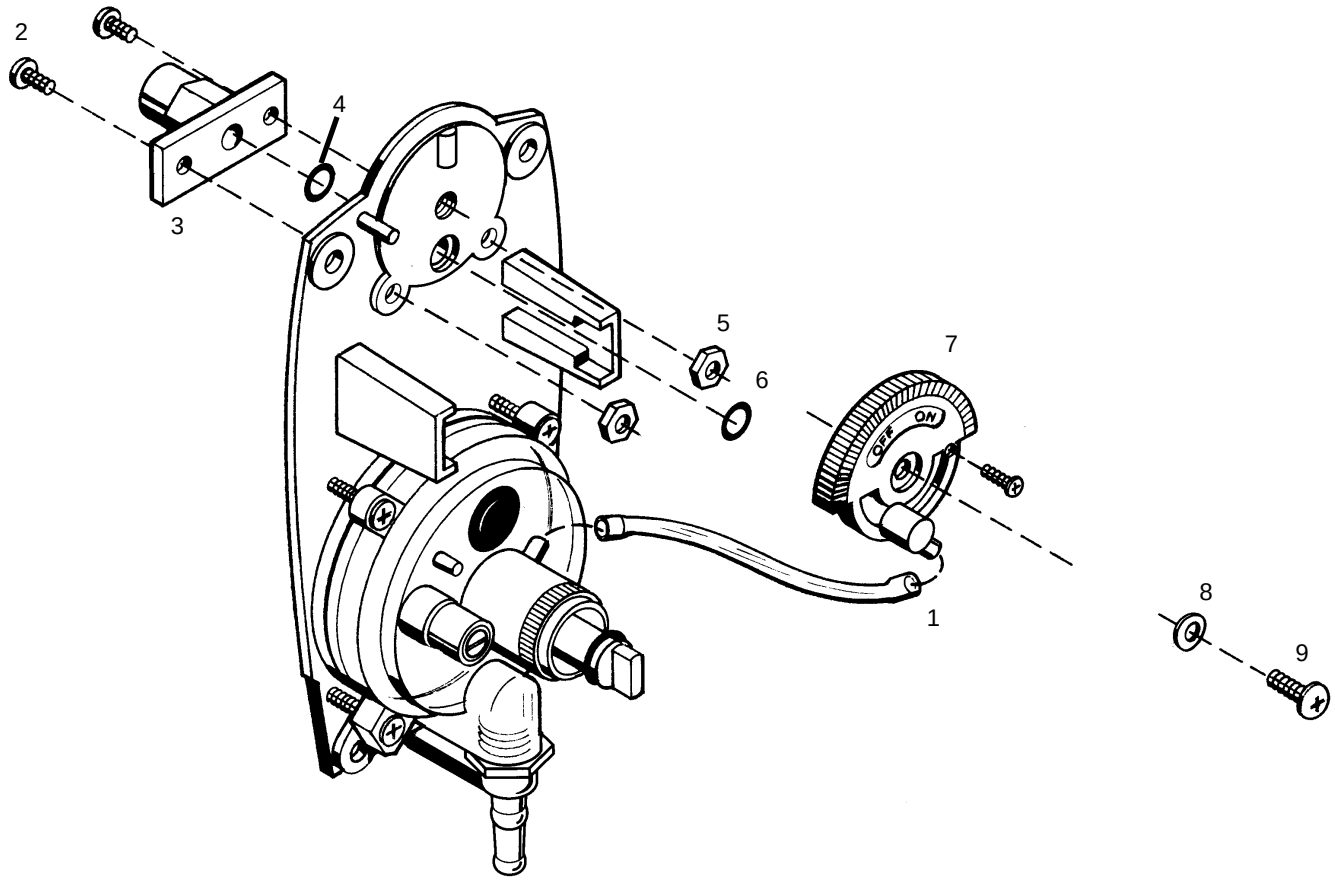

1. Control Knob . . . . . .0212-0806-100
2. Bent Metal Washer . . . . . .0202-3042-300
3. Plastic Spacers (2) . . . . . .0202-0063-300
4. Cover Mounting Screws (4) . . . . . .0142-4113-108

Restrictor tubes and orifice kit
(Includes items 5,6 and 7) . . . . . .6700-0429-850

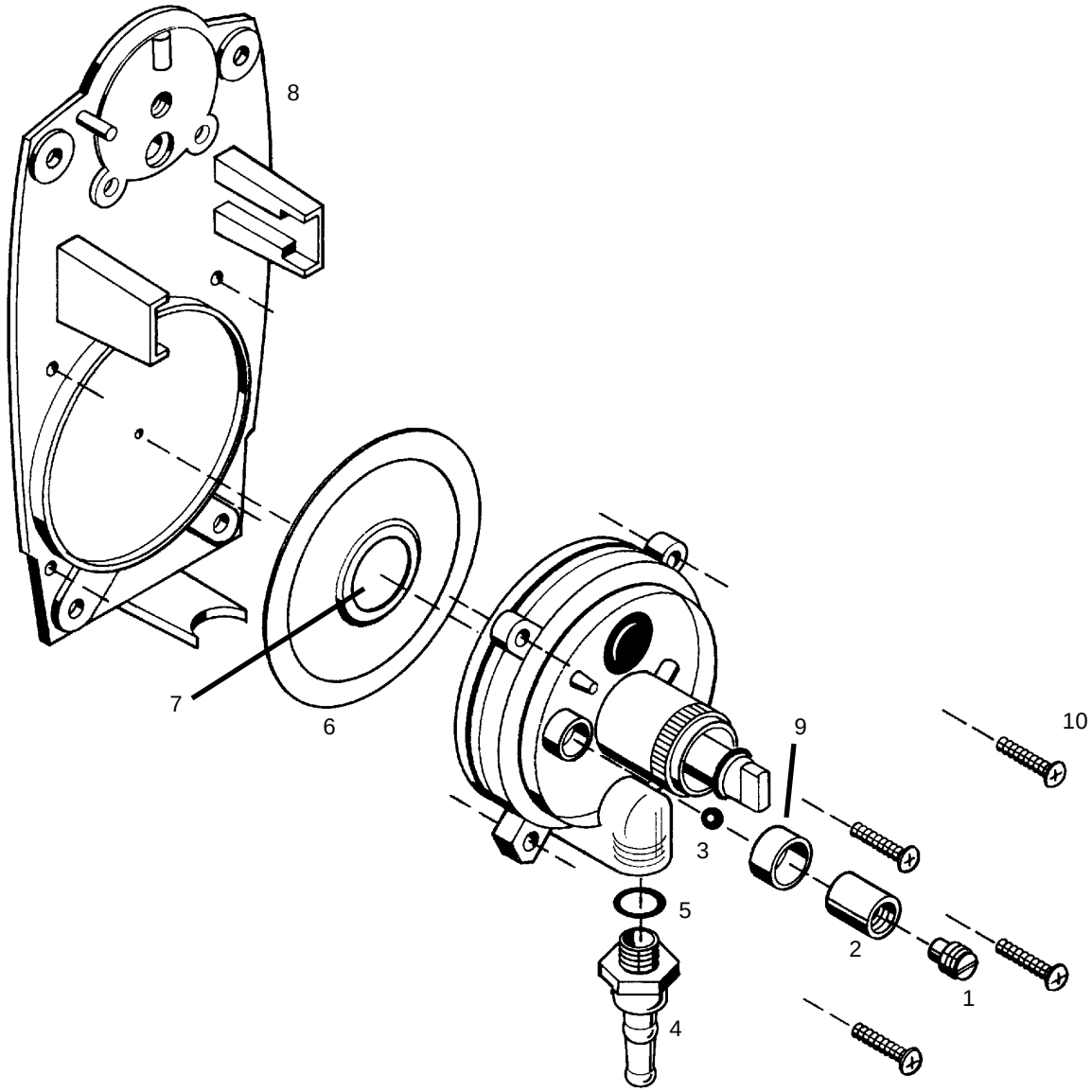
5. Restrictor Mounting Tube
6. Restrictor Orifice
7. Tube

Gauge kit (Includes items 8 and 9)
Domestic . . . . . .6700-0430-850
International . . . . . .6700-0431-850

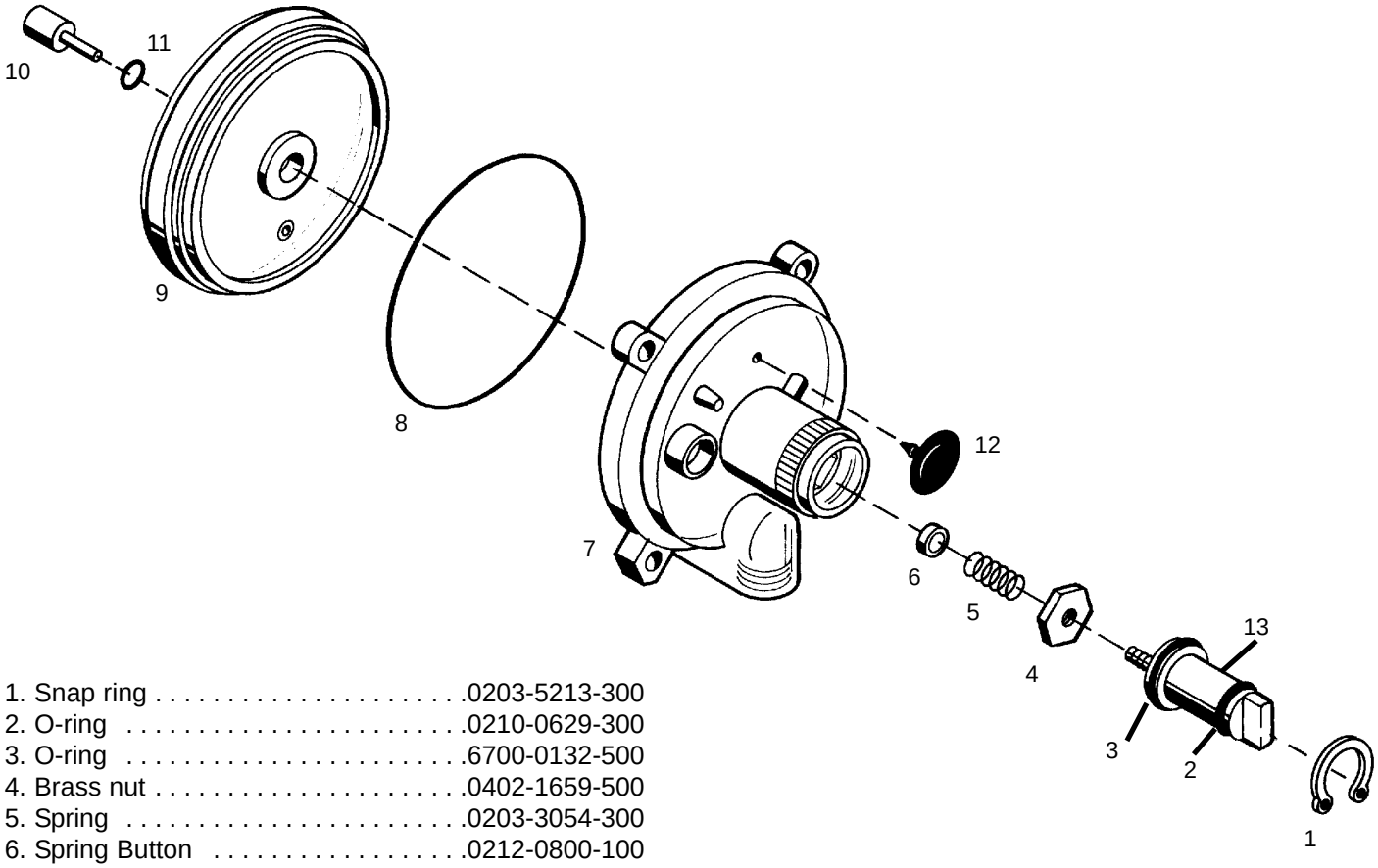
8. Barbed Fitting
9. Vacuum Gauge
10. Lens Cover . . . . . .6700-0087-500
11. Label (Domestic) . . . . . .0205-4366-300
(International) . . . . . .6700-0224-100
12. Front Cover
English . . . . . .6700-0155-400
French . . . . . .6700-0155-401
Spanish . . . . . .6700-0155-402




1. Vacuum Tube . . . . . .0211-0072-300
2. Probe/Adapter Mounting Screws (2) .0140-6624-108
3. Probe/Adapter connector . . . . . .0206-5149-300
4. O-ring . . . . . .0210-0629-300
5. Nuts (2) . . . . . .6700-0175-400
6. O-ring . . . . . .0210-0629-300
7. On/Off Selector switch
   (International – I/O) . . . . . .6700-0092-701
   (Domestic – ON/OFF) . . . . . .6700-0092-700
8. Spring washer . . . . . .0202-3030-300
9. Screw . . . . . .6700-0208-400




Vacuum Relief Adjustment Kit
(Includes items 1 and 2) . . . . . .6700-0432-850
1. Vacuum Relief Adjustment Screw
2. Vacuum Relief Body
3. Ball . . . . . .0409-1686-300
4. Patient port fitting . . . . . .0204-9046-535
5. O-ring . . . . . .6700-0130-500
6. Diaphragm . . . . . .0210-7300-100
7. Disc . . . . . .0214-3212-300
8. Backplate . . . . . .0212-0810-100
9. Rubber Sleeve . . . . . .0211-0719-500
10. Screws (4) . . . . . .0140-6124-112




1. Snap ring . . . . . .0203-5213-300
2. O-ring . . . . . .0210-0629-300
3. O-ring . . . . . .6700-0132-500
4. Brass nut . . . . . .0402-1659-500
5. Spring . . . . . .0203-3054-300
6. Spring Button . . . . . .0212-0800-100
7. Spring Case Cover . . . . . .0221-6365-300
8. O-ring . . . . . .6700-0100-400
9. Baffle-Guide Plate . . . . . .0212-0804-100
10. Piston . . . . . .6700-0099-400
11. O-ring . . . . . .0210-0527-300
12. Flapper Valve . . . . . .0211-1451-100
13. Control Shaft . . . . . .0221-6351-500

## 7.3 Assembly

Reassembly is the reverse of disassembly. Before reassembling the unit, sparingly lubricate all of the O-rings with Dow Corning No. 111.

⚠ **CAUTION:** To prevent stripping the plastic threads, place the screw in the hole and turn counterclockwise until it drops into the original threads. Tighten screw .

When installing the diaphragm, orient it with its metal section towards the metal piston of the regulator assembly. The rim of the diaphragm should fit over the outside of the diaphragm seat for a good seal. Do not lubricate the diaphragm. Tighten the regulator assembly mounting screws in an X pattern to prevent warpage. (Do not over tighten the screws).

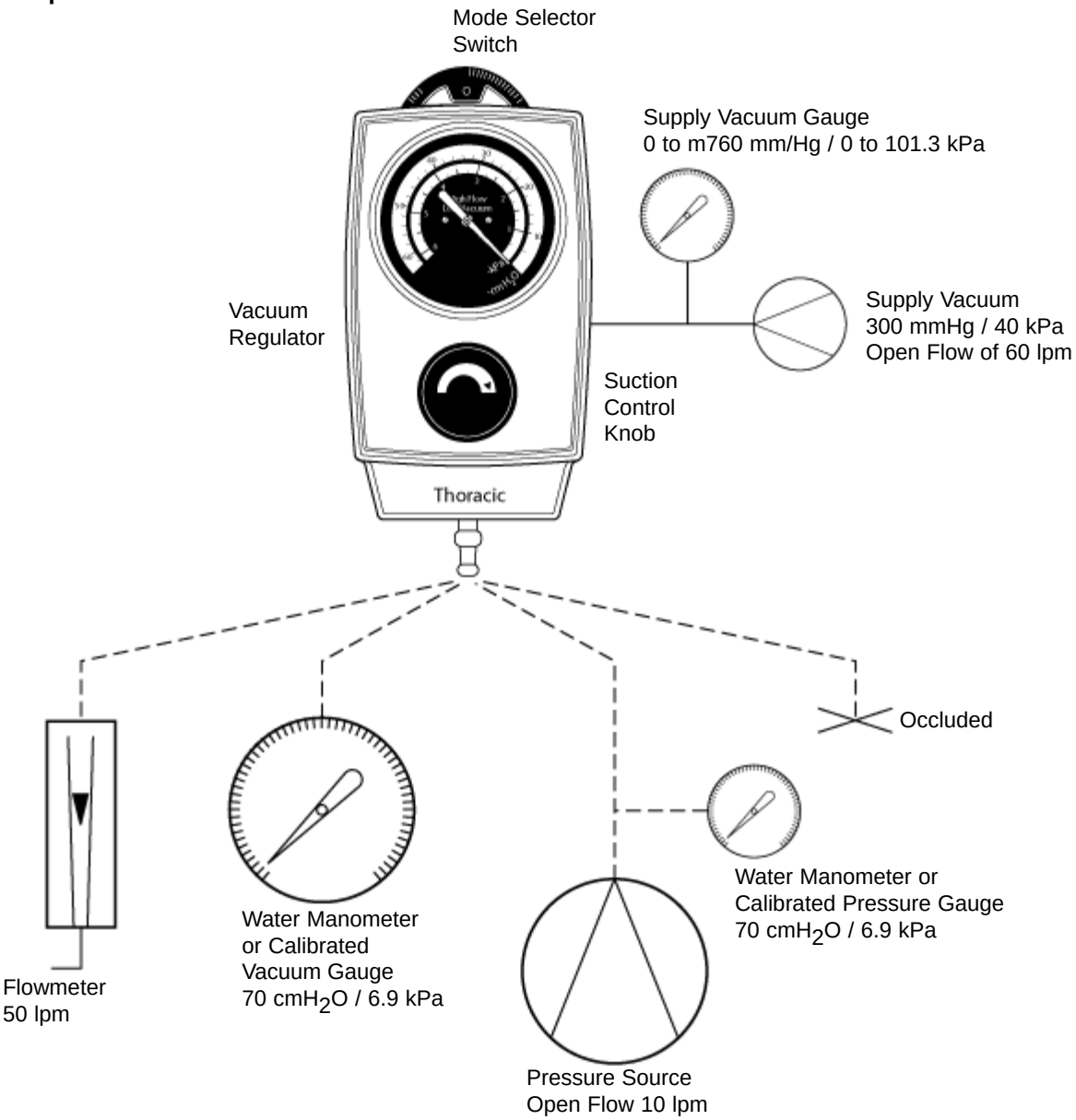
Before placing the front cover on a reassembled unit connect it to a functioning vacuum source and adjust the vacuum relief valve. Refer to section 8.5.

⚠ **WARNING: The vacuum relief valve must be tested to assure compliance with manufacturer's specifications before the unit is placed in service. Remove the unit from service if it fails the test. Otherwise, excessive suction can cause injury to a patient.**

Ensure that the conductive wire (if present) between the probe/adapter connector and the patient port fitting is properly connected.

**⚠ WARNING: If the vacuum regulator is repaired or disassembled in any manner, the Service Check-out Procedure must be performed before using the equipment on a patient.**

**Important:** This entire Service Check-out Procedure must be performed in numerical order.




## 8.1 Set-Up

1. Verify that there is a minimum of 300 mmHg (40 kPa) vacuum on the supply gauge.
2. The supply open flow must be at least 60 lpm.
3. Connect the supply vacuum to the probe/adapter port of the regulator.

## 8.2 Flow Test

1. Connect the regulator's patient port to the flowmeter with tubing. Use the shortest tubing possible with an inside diameter of 0.25 in (6mm) or larger.
2. Rotate the suction control knob fully clockwise (increase).
3. Turn the mode selector switch to On/I and verify that the flow rate is at least 40 lpm.
4. Turn the mode selector switch to Off/O and disconnect the flowmeter.

## 8.3 Gauge Test

**Note:** All Ohio Medical gauges are supplied with an accuracy of ± 5% of full scale deflection throughout their range.

**Note:** All gauge needles should come to rest at the stop pin when no suction is being supplied. Gauges which do not comply may be out of calibration.

When checking gauge accuracy, be sure that the calibration gauge has an accuracy of ±1 cmH2O (0.1 kPa) or better.

1. Connect the regulator's patient port to the calibration gauge with tubing.
2. Turn the mode selector switch to On/I.
3. Check that the regulator gauge is in agreement with the vacuum calibration gauge within the ± 3 cmH2O (0.3 kPa) tolerance. Recommended test points are 15, 30, and 45 cmH2O (1.5, 3, and 4.4 kPa).

## 8.4 Regulation Test

1. Disconnect the calibration gauge and occlude the patient port.
2. Set the vacuum level on the gauge to 30 cmH2O (3.0 kPa).
3. Open and close the patient port several times.
4. With the patient port occluded, the regulator gauge should return to the setting listed in step 2 within a tolerance of ± 3 $cmH_2O$ (0.3 kPa).

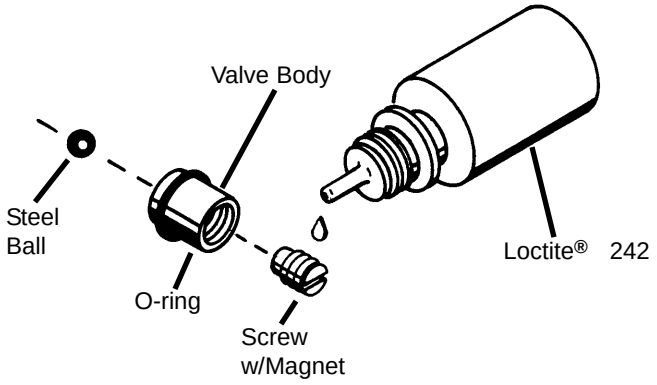
## 8.5 Vacuum Limit Test

1. Occlude the patient port of the regulator.
2. Turn the suction control knob fully counter clockwise (full decrease).
3. Slowly increase the vacuum and observe the gauge.
4. The vacuum relief valve should start opening between 50 and 60 cmH2O (4.9 and 5.9 kPa). The gauge needle may oscillate, but the vacuum should not increase beyond 65cmH2O (6.4 kPa) as the suction control knob is turned further clockwise.
5. If adjustment is required, grip the vacuum relief valve firmly with pliers and rotate the screw about 1/8 turn with a screwdriver. Repeat the previous step and check the suction level at which the valve opens.

   **Note:** Clockwise rotation will increase the suction level at which the relief valve opens. Counterclockwise rotation will decrease the suction level at which the relief valve opens.
6. When the desired limit is reached, lock the screw with a drop of removable thread locker Loctite® 242.

⚠ **WARNING: Excess Loctite® may seal the steel ball to the seat. This will disable the vacuum relief valve and may allow suction to exceed the pre-set limit.**

7. Repeat the steps one through four.

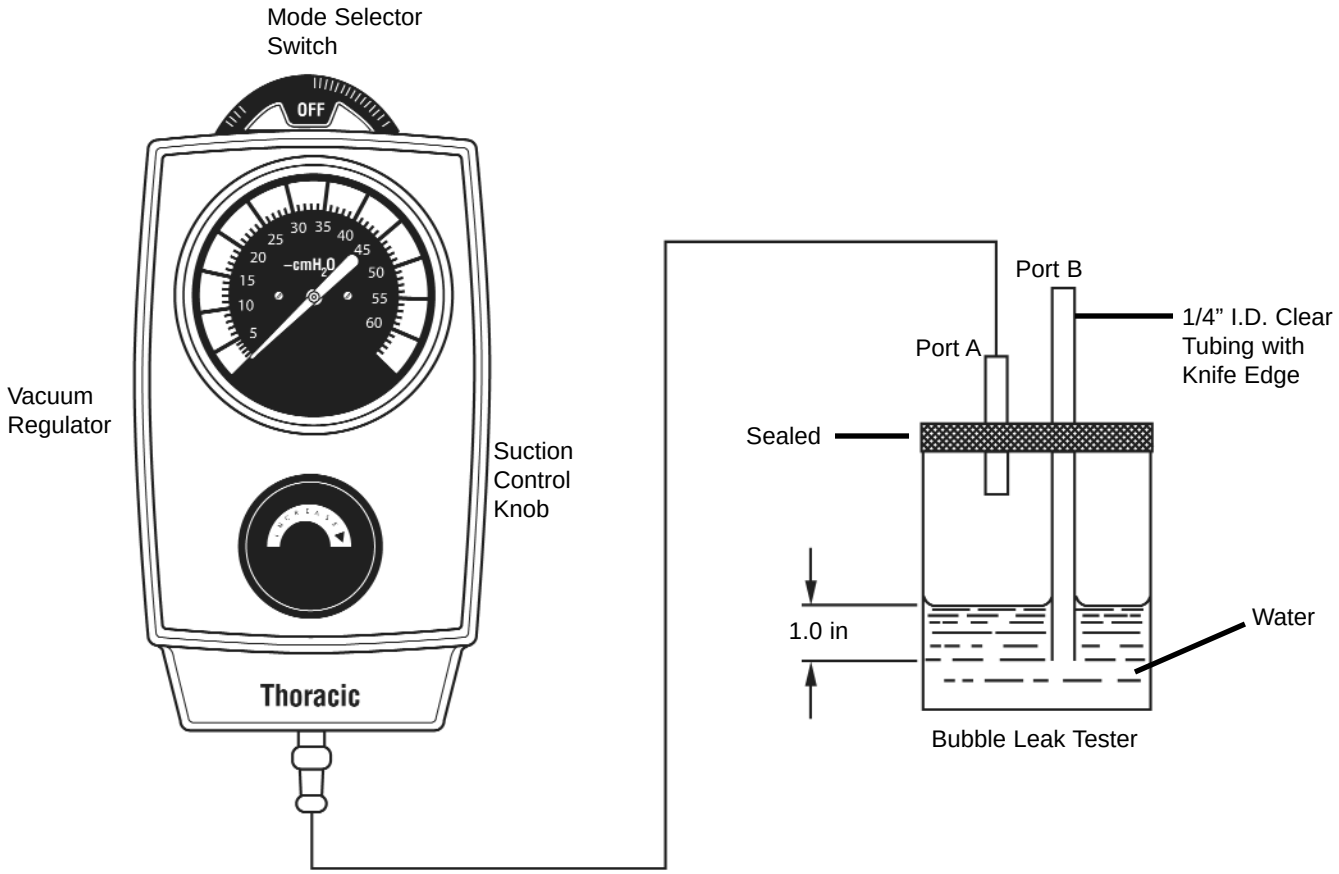


## 8.6 Positive Pressure Relief Test

1. Set the mode selector switch to Off/O.
2. Connect the pressure source and calibrated pressure gauge to the patient port of the regulator with tubing (see diagram on page 8-1).
3. Apply a positive pressure (@ 10 lpm open flow) and observe the calibrated pressure gauge.
4. The pressure should not exceed 10 cmH2O (1.0 kPa).

## 8.7 Leak Test

1. Connect the regulator patient port to the Bubble Leak Tester port “A” with tubing (see diagram below).
2. Set the mode selector switch to Off/O and check that the suction control knob is set approximately in the middle of its range.
3. Observe the Bubble Leak Tester. No bubbles should appear within 10 seconds.
4. Rotate the suction control knob fully in the counter clockwise (decrease) direction and turn the mode selector switch to On/I.
5. Observe the Bubble Leak Tester. No bubbles should appear within 10 seconds.




Bubble Leak Test Set-Up

## 9.1 General Maintenance of Suction Equipment

**⚠ WARNING: The Pre-Use Check-out Procedure must be performed before using this equipment on each patient. If the regulator fails any part of the Pre-Use Check-out Procedure, it must be removed from service and repaired by qualified service personnel.**

**⚠ WARNING: After patient use, regulators may be contaminated. Handle in accordance with your hospital's infection control policy.**

Vacuum Regulators should be kept in use or used on a rotating basis. Unused equipment may tend to deteriorate.

Maintenance of the vacuum piping system is as important as maintenance of the suction equipment. The use of collection bottles with reliable shut-off valves will protect the regulator and piping system. The flow rate at the wall outlet should be checked on a yearly basis and suitable cleaning of the outlets should be performed. The flow rate measurement should meet local standards.

Routine maintenance and inspection are important to the performance of suction equipment. The following is a recommended list for care of suction equipment after each patient use.

1. Perform a thorough cleaning by washing all bottles, tubing, metal connectors, etc, and removing all residue.

2. Wipe all exterior surfaces with a solution of water and mild detergent.

3. Perform a careful visual inspection.

4. Check that the High Flow Disposable Suction Filter is clean and in good condition.

5. Check that all tubing is in good condition and connected securely to the correct ports.

6. Check the floats in the Overflow Safety Trap and collection bottle for correct operation.

7. Perform the Pre-Use Check-out Procedure.

## 9.2 Recommended Maintenance Schedule

In addition to the Pre-Use Check-out Procedure, the following periodic maintenance should be performed.

9.2.1 Maintenance Schedule

| Item | Minimum Frequency | Comments |
|---|---|---|
| Service Check-out | Every 4 months | If the regulator does not pass the Service Check-out Procedure, refer to the Troubleshooting section of this manual. Repair as necessary. |
| Elastometric Components<br>• Positive pressure safety relief (flapper) valve<br>• Switch O-ring<br>• Low vacuum relief valve sleeve<br>• Control shaft O-rings<br>• Patient port O-ring<br>• Probe/Adapter connector O-ring | Inspect every 4 months; Replace every 24 months | Replace as necessary to minimize in-use failures. |
| High Flow | Replace after each | Replace more frequently |
| Disposable Suction Filter if flow deteriorates | patient use | |

## 9.3 Repair Policy

**⚠ WARNING: Clean and sterilize all suction equipment before shipment to ensure transportation personnel are not exposed to any hazardous contamination.**

**⚠ CAUTION: Do not steam autoclave or liquid sterilize the regulator. Severe impairment of the operation of the regulator will result. The only acceptable method of sterilization is with gas (ethylene oxide).**

**⚠CAUTION: Only competent individuals trained in the repair of this equipment should attempt to service it.**

Do not use malfunctioning equipment. Make all necessary repairs. Have the equipment repaired by qualified service personnel or by Ohio Medical. Parts listed in this service manual may be repaired or replaced by a competent, trained person who has experience in repairing devices of this nature. After repair, perform the Service Check-out Procedure to ensure that the equipment is functioning properly, and complies with the published specifications.

## 9.4 Technical Assistance

If technical assistance is required, contact Ohio Medical technical support or field operations listed on the back cover.

## 9.5 Return Instructions

1. Clean and sterilize the vacuum regulator.

2. Package the vacuum regulator securely for protection; preferably in the original container.

3. Include a letter describing in detail any difficulties experienced with the vacuum regulator. Include the person, title, and telephone number to contact for questions.

4. Ohio Medical now offers a ten year warranty on vacuum regulators sold on or after July 1, 2005. If the vacuum regulator was purchased on or after July 1, 2005 and is less than ten years old or if the vacuum regulator is covered under the previous warranty and is less than five years old, include the warranty information that came with the device and a copy of the invoice.

5. Include a purchase order to cover repair of a regulator not under warranty.

6. Ship the vacuum regulator prepaid. Write your return address and billing address information on the package or letter that comes with the package.

   For U.S.A. Warranty Repairs (purchased on or after July 1, 2005 and is less than ten years old form the purchase date or if the vacuum regulator is covered under the previous warranty and is less than 5 years old from the purchase date) mail the package to:

   Ohio Medical Corporation
   1111 Lakeside Drive
   Gurnee, IL 60031 USA

   For U.S.A. Non-Warranty Repairs (more than ten years older under the new warrant or more than five years sold under the previous warranty) mail the package to

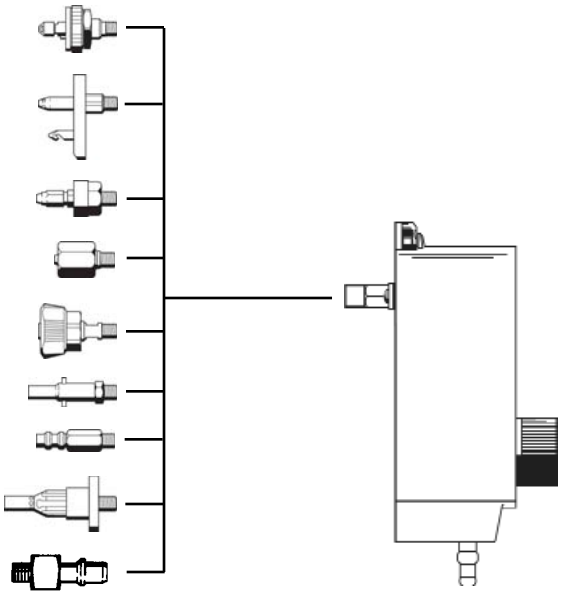
Ohio Medical Corporation
1111 Lakeside Drive
Gurnee, IL 60031 USA

In other locations contact your nearest Ohio Medical office or authorized Ohio Medical distributor.

## 10.1 Service Parts

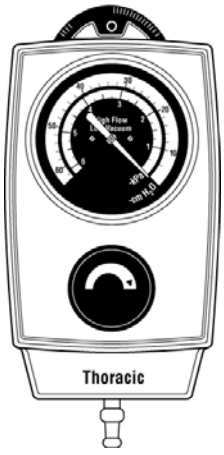
See section 7/Service - Disassembly and Assembly for listings of service parts.

## 10.2 Adapters (Probes)

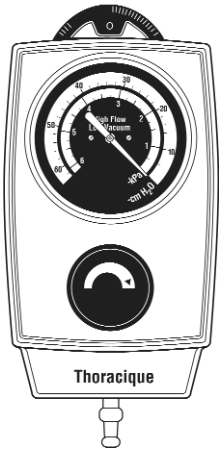


1. Diamond Adapter . . . . . .6700-0300-802
2. NCG Adapter (round) . . . . . .6700-0505-802
   NCG Adapter (rectangle) . . . . . .6700-0500-802
3. Schrader Adapter . . . . . .0221-0690-731
4. DISS Union Nut & Gland . . . . . .6700-0094-700
5. DISS Hand-I-Twist Nut Gland . .6700-0510-802
6. OES Adapter . . . . . .0221-0152-300
7. Puritan Adapter . . . . . .6700-0535-802
8. Medstar Adapter . . . . . .0221-0163-300
9. Dräger Adapter . . . . . .6700-0051-700

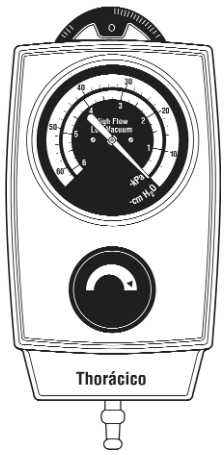
## 10.3 International Regulator Options




English
6700-1276-901




French
6700-1277-901



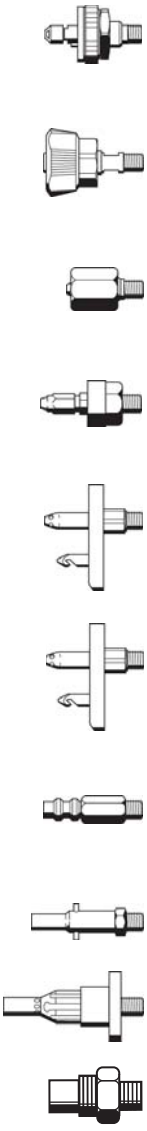

Spanish
6700-1278-901

## 10.4 North American Regulator Options

Select the adapter to form an 11-digit part number.

| | | | |
|---|---|---|---|
| Example: 6701-1275-901 = | 6701<br>Diamond<br>Adapter | 1275<br>North American<br>Thoracic Regulator | 901<br>Tubing<br>Nipple |

### Adapters 67XX



**6700**
w/ 1/8” NPT Female

**6701**
Ohio Diamond

**6702**
DISS Hand-I-Twist
(HIT)

**6703**
DISS Nut and Gland

**6704**
Schrader

**6705**
Chemetron Rectangle
(NCG)

**6706**
Chemetron Round
(NCG)

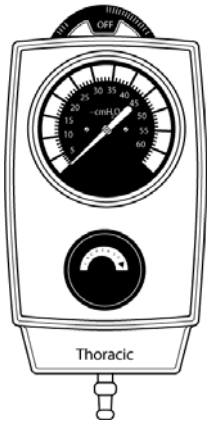
**6707**
Puritan-Bennett

**6708**
O.E.S.

**6709**
O.E.S. MedStar

**6714**
DISS Male

### Regulator 1275

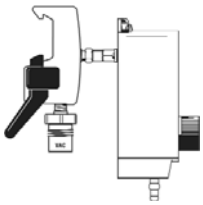



North American
6700-1275-901

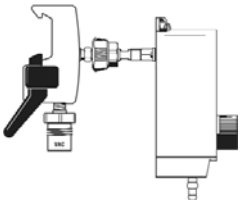
### Fitting 901

6722-1275-901

The following Ohio Medical rail options are also available



Regulator & Rail Bracket,
DISS Male
6713-1275-901



Regulator & Rail Bracket,
DISS Hand-I-Twist, and
DISS male
6722-1275-901

## Installation procedure for Probes/adapters

All probes/adapters should be sealed and installed properly to prevent leaks and to support the equipment when mounted. The probe/adapter port is a 1/8-27 NPTF tapered pipe thread. It is important to note that probes/adapters seal on the thread and may have threads exposed after they have been tightened properly
.
Prior to installing the probe/adapter, seal the thread with Teflon® (PTFE) tape or one of the following lubricants:

Dow® 111 (6700-0074-200)

⚠ **CAUTION:** Do not use any Loctite® products, or products which contain Methacrylate Ester as an active ingredient, to seal the probe/adapter threads.

The torque range for installing probes/adapters is 4.0 ft-lb (5.4 N-m) minimum to 10.0 ft-lb (13.6 N-m) maximum.

Probes/adapters which are not keyed for specific orientation, should be torqued to approximately 6.0 ft-lb (8.1 N-m).

Probes/adapters that are keyed to specific orientation, must be torqued initially to 4.0 ft-lbs. Additional torque is applied only until orientation is correct.

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